**What is claimed is:**

**1.** A wastewater treatment system comprising:

a vertical flow marsh cell adapted to contain a first particulate media and having a top surface, an outlet adjacent a bottom thereof, and means for supporting plants so as to permit roots thereof to extend into the first media, the roots and the first media thereby positioned to contact water flowing into and downward through the marsh cell;

a subsurface horizontal wetland adapted to contain a second particulate media and to support vegetative growth upon a top surface thereof so as to permit roots thereof to extend into the second media, the roots and the second media thereby positioned to contact water flowing substantially horizontally and downward through the wetland;

means for transporting water to be treated and water exiting the marsh cell outlet to a top surface of the wetland adjacent a first end thereof;

means for recycling water from an outlet adjacent a bottom of the wetland adjacent a second end, the second end opposed to the first end, to the marsh cell top surface; and

means for discharging treated water from the wetland outlet.

**2.** The wastewater treatment system recited in Claim 1, further comprising means for establishing a community of aquatic invertebrates in the marsh cell adapted to consume biological and organic particles in the water, for reducing yield therein.

3. The wastewater treatment system recited in Claim 1, further comprising means for controlling the recycling means and the means for transporting water exiting the marsh cell in order to effect cycles of filling and draining of the marsh cell.

4. The wastewater treatment system recited in Claim 3, wherein the controlling means comprises controlling a time during which the marsh cell is substantially drained sufficient to effect aeration of the first media and the plant roots.

5. The wastewater treatment system recited in Claim 4, wherein the marsh cell drained time is further sufficient to permit sufficient aeration to substantially prevent biomass buildup on a surface of the first media.

6. The wastwater treatment system recited in Claim 3, wherein the marsh cell comprises a plurality of marsh cells, and the controlling means comprises means for ensuring that at least one marsh cell contains water and at least one marsh cell is substantially drained.

7. A system for improving a performance of a subsurface horizontal flow wetland wastewater treatment device comprising:

a vertical flow marsh cell adapted to contain a first particulate media and having a top surface, an outlet adjacent a bottom thereof, and means for supporting plants

so as to permit roots thereof to extend into the first media, the roots and the first media thereby positioned to contact water flowing into and downward through the marsh cell;

means for transporting water exiting the marsh cell outlet to a top surface of the wetland adjacent a first end thereof; and

means for recycling water from a wasteland outlet adjacent a second end, the second end opposed to the first end, to the marsh cell top surface.

**8.** The wastewater treatment system recited in Claim 7, wherein the marsh call is adapted to support an ecological community capable of reducing system yield to effectively zero over time.

**9.** A wastewater treatment system comprising:

a vertical flow marsh cell having a top surface and an outlet adjacent a bottom thereof;

a first particulate media housed within the marsh cell;

wetland plants positioned atop the first media so as to permit roots thereof to extend into the first media, the roots and the first media thereby positioned to contact water flowing into and downward through the marsh cell;

a subsurface horizontal wetland having an inlet adjacent a first end and adjacent a top surface thereof, an outlet adjacent a second end generally opposed to the first end and adjacent a bottom thereof;

a second particulate media housed within the wetland;

vegetative growth positioned upon the wetland top surface thereof, so as to permit roots thereof to extend into the second media, the roots and the second media thereby positioned to contact water flowing substantially horizontally from a first end to the second end and downward through the wetland from the top surface to the bottom;

means for transporting water to be treated and water exiting the marsh cell outlet to the wetland inlet;

means for recycling water from the wetland outlet to the marsh cell top surface; and

means for discharging treated water from the wetland outlet.

**10.** The wastewater treatment system recited in Claim 9, wherein the marsh cell comprises a substantially impermeable basin, and the marsh cell outlet comprises a bottom drain collection system.

**11.** The wastewater treatment system recited in Claim 10, wherein the means for transporting water exiting the marsh cell outlet comprises a level sensor positioned within the basin and an automatic valve assembly actuated by the level sensor.

**12.** The wastewater treatment system recited in Claim 10, wherein the means for transporting water exiting the marsh cell outlet comprises a drain pump.

**13.** The wastewater treatment system recited in Claim 9, wherein the first particulate media in the marsh cell has a depth less than or equal to 4 feet.

**14.** The wastewater treatment system recited in Claim 9, wherein the first media comprises an aggregate comprises elements having a diameter no greater than 1 mm for a system desired to produce treated water to tertiary treatment standards and a diameter no greater than 4 mm for a system desired to produce treated water to one of primary and secondary treatment standards.

**15.** The wastewater treatment system recited in Claim 14, wherein the first media comprises expanded shale.

**16.** The wastewater treatment system recited in Claim 9, wherein the marsh cell comprises a modular, prefabricated unit for above-ground installation.

**17.** The wastewater treatment system recited in Claim 16, wherein the means for transporting water exiting the marsh cell outlet comprises a drainage siphon.

**18.** The wastewater treatment system recited in Claim 9, wherein the marsh cell has a depth from a top to the bottom, the first media has a depth from the bottom to the marsh cell top surface, and a difference between the marsh cell depth and the first media depth is sufficient to permit the creation of a free water surface above the top surface.

**19.** The wastewater treatment system recited in Claim 18, further comprising a colony of photosynthetic organisms attached to the plants adapted to oxygenate water in the free water above the top surface.

**20.** The wastewater treatment system recited in Claim 18, wherein the difference comprises an operating depth less than or equal to 2 feet.

**21.** The wastewater treatment system recited in Claim 9, wherein the water recycling means comprises a pump in fluid communication with the wetland outlet and a low-head distribution system in fluid communication with the pump, the distribution system positioned to discharge water onto the marsh cell top surface.

**22.** The wastewater treatment system recited in Claim 21, wherein the distribution system is adapted to disperse an energy of discharged water at an energy sufficient to avoid scouring of a surface of the first media.

**23.** The wastewater treatment system recited in Claim 9, further comprising means for controlling the recycling means and the means for transporting water exiting the marsh cell in order to effect cycles of filling and draining of the marsh cell.

**24.** The wastewater treatment system recited in Claim 23, wherein the controlling means comprises controlling a time during which the marsh cell is substantially drained sufficient to effect aeration of the first media and the plant roots.

**25.** The wastewater treatment system recited in Claim 24, wherein the marsh cell drained time is further sufficient to permit sufficient aeration to substantially prevent biomass buildup on a surface of the first media.

**26.** The wastewater treatment system recited in Claim 21, wherein the pump comprises one of an axial flow propeller pump and an airlift pump.

**27.** The wastewater treatment system recited in Claim 21, wherein the low-head distribution system comprises one of a large-diameter slotted irrigation pipe and an open-channel distribution system.

**28.** The wastewater treatment system recited in Claim 9, wherein the inlet comprises a top surface of the wetland, and the means for transporting water to be treated and water exiting the marsh cell outlet comprises first and second distribution piping, respectively, each adapted to distribute water across the wetland top surface adjacent the first end.

**29.** The wastewater treatment system recited in Claim 9, wherein the second media comprises at least one of a fine and a medium gravel.

**30.** The wastewater treatment system recited in Claim 9, further comprising a sump adapted to receive water exiting the wetland outlet, and wherein the recycling means comprises a recycle pump positioned in fluid communication with the sump.

**31.** The wastewater treatment system recited in Claim 30, wherein the discharging means comprises an overflow discharge outlet in the sump.

**32.** The wastewater treatment system recited in Claim 30, wherein the recycling means further comprises one of a level sensor positioned in the sump and a timer in controlling relation to the recycle pump.

**33.** The wastewater treatment system recited in Claim 9, wherein the marsh cell comprises a plurality of marsh cells configured in a parallel orientation, and the recycling means comprises means for splitting the water being recycled substantially evenly among the marsh cells.

**34.** The wastewater treatment system recited in Claim 9, further comprising a first coir mat positioned atop the marsh cell top surface and a second coir mat positioned atop

the wetland top surface, the first and the second mats, the wetland plants and the vegetative growth growing in the first and the second mats, respectively.

**35.** A system for improving a performance of a subsurface horizontal flow wetland wastewater treatment device comprising:

a vertical flow marsh cell having a top surface and an outlet adjacent a bottom thereof;

a first particulate media housed within the marsh cell;

wetland plants positioned atop the first media so as to permit roots thereof to extend into the first media, the roots and the first media thereby positioned to contact water flowing into and downward through the marsh cell;

means for transporting water exiting the marsh cell outlet to a subsurface horizontal flow wetland inlet; and

means for recycling water from a subsurface horizontal flow wetland outlet to the marsh cell top surface.

**36.** A method for treating wastewater comprising the steps of:

exposing wastewater to be treated to a first environment that is substantially anaerobic/anoxic;

transporting water from the first environment to a second environment containing a negatively charged surface to which ammonia ions can adsorb;

aerating the adsorbed ammonia ions to permit exposure thereof to oxygen;

permitting nitrification of the ammonia ions into nitrate ions;

flooding the second environment to permit the nitrate ions to desorb into bulk water;

transporting the bulk water back to the first environment; and

exposing the nitrate ions to bacterial respiration in the first environment to yield nitrogen gas.

**37.** The treatment method recited in Claim 36, wherein the aerating step comprises draining the first environment, and wherein the draining and flooding steps are repeated cyclically.

**38.** The treatment method recited in Claim 37, wherein a cycling time of the draining and the flooding steps comprises less than one day.

**39.** The treatment method recited in Claim 36, further comprising the steps of:

reducing nitrate to nitrite in the second environment; and

using the nitrite to oxidize ammonia directly to nitrogen gas.

**40.** The treatment method recited in Claim 36, further comprising oxygenating water contained in a free water surface above the second environment during the flooding step.

**41.** The treatment method recited in Claim 36, further comprising the steps of:

reducing the nitrate in the second environment to nitrite; and

oxidizing ammonia to nitrogen gas using the nitrite.

**42.** The treatment method recited in Claim 37, wherein the aerating step comprises draining water from the second environment.

**43.** The treatment method recited in Claim 42, wherein the flooding and the draining steps are performed cyclically.

**44.** The treatment method recited in Claim 42, wherein a time for the draining step is much greater than a time for the flooding step.

**45.** A method for improving a performance of a substantially anaerobic/anoxic subsurface horizontal flow wetland wastewater treatment device comprising the steps of:

transporting water from an outlet of a first environment comprising a wetland to a second environment containing a negatively charged surface to which ammonia ions can adsorb;

aerating the adsorbed ammonia ions to permit exposure thereof to oxygen;

permitting nitrification of the ammonia ions into nitrate ions;

flooding the second environment to permit the nitrate ions to desorb into bulk water; and

channeling the bulk water back to the wetland, wherein the nitrate ions are exposed to bacterial respiration to yield nitrogen gas.

**46.** The method recited in Claim 45, further comprising the step, prior to the water transporting step, of introducing influent wastewater to the wetland, and wherein the channeling step further serves to dilute the influent wastewater.

**47.** The method recited in Claim 45, wherein the aerating step comprises draining water from the second environment.

**48.** A method of constructing a wastewater treatment system comprising the steps of:

establishing a first environment adapted to maintain an aerobic/anoxic state;

establishing a second environment adapted to cycle between an aerobic/anoxic state and an aerated state;

establishing fluid communication between an inlet of the second environment and an outlet of the first environment, and between an outlet of the second environment and an inlet of the first environment; and

establishing a community of bacteria and aquatic invertebrates in the second environment, the bacteria adapted to nitrify ammonia ions to nitrate ions when the second environment is in the aerated state, the aquatic invertebrates adapted to consume excess biomass in the second environment.

**49.** The method recited in Claim 48, wherein the bacterial community establishing step comprises establishing wetland plants having roots extending into the second environment, the roots serving as a surface to which bacteria can adsorb and form a biofilm.

**50.** The method recited in Claim 49, wherein the wetland plant establishing step comprises positioning pregrown plants atop the second environment, for permitting a rapid establishment of a desired ecosystem in the second environment.

**51.** A method of retrofitting a wetland wastewater treatment system for the purpose of improving a performance thereof, the method comprising the steps of:

establishing a marsh environment adapted to cycle between an aerobic/anoxic state and an aerated state;

establishing means for transporting water to an inlet of the marsh environment from an outlet of a wetland, and from an outlet of the marsh environment to an inlet of the wetland; and

establishing a community of bacteria and aquatic invertebrates in the marsh environment, the bacteria adapted to nitrify ammonia ions to nitrate ions when the marsh environment is in the aerated state, the aquatic invertebrates adapted to consume excess biomass in the marsh environment.

**52.** The method recited in Claim 51, wherein the marsh environment establishing step comprises filling a vessel with a media and establishing a community of wetland plants atop the media, the media adapted to permit growth of plant roots thereinto.

**53.** The method recited in Claim 52, wherein the marsh environment inlet is positioned above the media and the marsh environment outlet is positioned adjacent a bottom of the vessel, thereby providing for downward flow through the media and the plant roots.

**54.** The method recited in Claim 52, wherein the bacteria and aquatic invertebrate community establishing step comprises permitting biofilm growth upon surfaces of the media and the plant roots, the biofilm comprising the bacteria, and maintaining conditions within the marsh environment conducive to aquatic invertebrate growth.